TESTIMONY before the US HOUSE COMMITTEE ON SCIENCE
05 May, 2004

Dr. Leonard J. Pietrafesa
Professor and Director, Office of External Affairs
College of Physical & Mathematical Sciences
North Carolina State University
Raleigh, North Carolina 27695-8201

Introduction

Good Morning. My name is Dr. Leonard J. Pietrafesa and I am the Director of the Office of External Affairs in the College of Physical and Mathematical Sciences and a Professor at North Carolina State University in Raleigh, NC. I have been author or co-author of 165 peer reviewed publications in the areas of oceanography and meteorology and estuary and climate dynamics impacts. I have served as Chair of the Board on Oceans and Atmosphere of the National Association of State Universities and Land Grant Colleges (NASULGC) and as Chair of the Council on Ocean Affairs, the precursor to the Consortium for Oceanographic Research and Education (CORE). Presently, I am on the Board on Trustees of the University Corporation for Atmospheric Research, am the Chair of the Educational Advisory Committee of the American Meteorological Society and am the Chair of the NOAA Science Advisory Board, which falls under FACA.

The subject of my testimony is related to the Recommendations which have emanated from the bold, visionary and long awaited, U.S Ocean Commission on Ocean Policy Report (USCOP) and is detailed in five questions which I will address individually.

The considerable challenges to the agency are reflected in the 198 recommendations dealing directly with NOAA in the USCOP Report.

Now to the questions posed.

1. **What are the current strengths and weaknesses of ocean and coastal programs at the National Oceanic and Atmospheric Administration?**

   First (20 amongst many) strengths:

   a. Agency Personnel

   b. Advancing the technology for and maintaining the real time National Water Level Network focused on the Nation's 150 major ports

   c. Continued advances in Operational Forecasting and evaluation metrics

   d. Developing a large suite (~119) of coastal environmental models

e. Advancing the facilitation of the continuously operating incredibly precise lateral and vertical spatial observing network, including more hydrographic surveys to supplement the GPS satellite constellation and height modernization

f. Advancing the robust Shoreline Mapping Program

g. Conducting long term estuary specific research programs

h. Sea Grant Extension's terrific job of moving the results of R & D into information that coastal managers and other stakeholders can understand and utilize

i. The Tropical Atmospheric and Oceanic Observing Array

j. The visionary and reliable NOAA (and partner agencies) continual suite of Earth observing satellites, such as:

Upcoming NOAA Launches

Satellite	Launch Date	Mission Changes
NOAA-M (17) (1030)	Launched 6/24/02(Titan II)	Mid-morning orbit, prototype solid state recorders
GOES-12 (geo)	Launched 7/23/02	CO_2 imager channel, 4-km H_2O_v channel, SXI
WindSat (0600)	Launched 1/6/03 / USN (Titan II)	Polarimetric microwave radiometer
DMSP F-16	Launched 10/18/03 / USAF (Titan II)	SSMIS
GOES-N (geo)	Dec 2004	1st of new series
NOAA-N (1330)	Jan 2005	Solid-state recorders, MHS
DMSP-F17	2005 / USAF (EELV)	(Launch Date = F-16 + 24 mths)
METOP-1 (0930)	**Dec 2005 / EUMETSAT**	**Global 1-km AVHRR, ASCAT, IASI, MHS, GOME, GRAS, Argos-III**
NPP (1000)	Oct 2006	VIIRS, CRIS, ATMS, OMPS
GOES-O (geo)	April 2007	4-km resolution CO_2 channel
NOAA-N' (1330)	Jun 2008	Argos-III (2-way messaging capability)
GOES-P (geo)	Oct 2008	None
Earth Observing-3 (geo)	2009 **(TBD)** / NASA	GIFTS (GOES Risk Reduction)
NPOESS C-1 (1330)	Jan 2010	VIIRS, CRIS, ATMS, CMIS, GPSOS, OMPS, SESS
METOP-2 (0930)	**2010 / EUMETSAT**	
GOES-R (geo)	2012	ABI, HES, Lightning Mapper, Coronograph

Missions colored "Green" include active sensors

k. The Argos drifter technology and drifter network strategy

l. The National Estuarine Research Reserve Program

m. Good coordination with Coastal Managers and Emergency Management responders

n. NOAA's recent leadership of ocean observations which has recently grown to annual expenditures of ~ $400M

o. NOAA's recent national and international leadership roles: such as NOAA Administrator VADM C. L. Lautenbacher Jr. being the lead for the US, and one of four in the World, in the Earth Observing Summit; Assistant Administrator Dr. R. Spinrad's roles as Co-Chair (with Dr. M. Leinen of NSF) on the Joint Sub-committee on Oceans within OSTP, the US representative to the Inter-Governmental Ocean Commission and as Chair of Ocean.US, to name but several

Next (20 amongst many of) the weaknesses:

a. A serious under sampling of state variables in both the water and atmospheric oceanic, coastal, Great Lakes and estuary environments of the Nation. These data are important for: systematically documenting the spatial and temporal histories of the entire suite of phenomena which occur that affect and effect the Nation's and the Planet's weather and climate interactively coupled physical, biological, chemical and human socio-economic and health systems; to ground truth NOAA's and NASA's satellite sensors; and to drive to drive the development of interactively coupled diagnostic and predictive models, to assimilate data into the models, and for model validation. In the immediate future, these models could routinely and automatically forecast all environmental conditions over multiple time and space scales

b. USCOP has outlined a bold role for NOAA in establishing and supporting the International Ocean Observing System (IOOS). There is much in house strength within NOAA. However, there are several principal concerns with this: NOAA does not have all the in-house capabilities to provide the necessary leadership and technical skills in these areas; herein, NOAA's budget process does not easily and readily permit planning for engagement with the extramural community. It tends to be highly political-centric

c. It may be difficult to 'squeeze' the resources needed to build and sustain for IOOS into NOAA appropriations. Why? NOAA, within its parent Department Commerce, along with the departments of Justice and State, two perennial Hill favorites, exists in the smallest of the 13 appropriations bill

d. There is growing evidence that both the Navy and NASA are backing away from environmental observations in the oceans in general and the coastal environment in particular because of massive budget cuts to their agencies and the reprogramming of the resources that remain. NOAA cannot and should not go it alone. As such, NOAA's past and

present dependence on NASA compromises NOAA's ability to meet its' mission

e. An end-to-end no-gaps new satellite system and succession system network funding strategy must be conceived for NOAA (The model of USGCRP's budget formulation and budget execution might provide some worthwhile lessons as this ball is pushed uphill). NASA satellites that are absolutely critical to NOAA's mission include, but are limited to: EOS Aqua and Terra; QuikSat; SeaWifs; Acquarius; Ocean Carbon Observation; Global Precipitation Mission; ICES. The lost of any of these amongst others would be devastating

f. Under funding of NOAA Data Centers archive and retrieval capabilities. For example the operations budget for all NOAA Data Centers is $34M in total, including the costs libraries. By contrast, the NASA DAAC budget is $70M. NASA maintains a research archive but NOAA maintains operational archives to which there must be real time access and an ability to mine data on the fly

g. While the weather detection signal is usually strong, attention to the high resolution, precision and accuracy of the existing and new observing system instrumentation required to document climate signals is sometimes overlooked

h. Assessment of performance of Coastal Zone Management activities. $130M is being spent annually and what is there to show for it? Unbridled, unabated coastal development, growing coastal water quality degradation, further destruction of maritime forests, destruction of marine fish, bird and mammal habitats, further destruction of wetlands, ill advised dredging of inlets and so on.

i. Ocean Exploration expenditures presently are at $15M annually but the realistic need is for ~ $100M annually

j. Connections of ocean and coastal information to educational venues, from "K to Gray"

k. A perceived lack of taking more extensive advantage of leveraging the intellectual and physical resources of the academic community. NOAA does leverage its inhouse scientific talent with universities through various programs, including the National Sea Grant College Program, Joint and Cooperative Insititutes, the Educational Partnership Program with minority serving institutions, Ocean and Coastal Remote Sensing Programs, the Coastal Ocean Program, Ocean Exploration and the National Undersea Research Program. Herein, NOAA expended nearly $257M on extramural research in FY03,

almost 35% of the agency's entire R&D budget. Nonetheless, the University community has had difficulty tracking the true pathway of the external monies and is viewed as being abyssmally low for the needs and responsibilities of the agency and compromises the agency's ability to more fully meet its responsibilities. This strategy also encourages earmarks

l. The lack of a robust "test bed" enterprise in which new advances in tehnology by the external community that could be of benefit to NOAA could be tested out for efficacy and application via more NOAA/University partnerships. These are potentially low cost, high return investments

m. NOAA operates the largest fleet of research and survey vessels of any federal agency (18 ships by 2005; 14 aircraft; as well as global ocean observing capability from research and operational satellites). Albeit, NOAA funded grant researchers have had to pay for the use of ships out of their grants which has a significant impact on the viability of those grants and presents a huge disincentive to do field work on behalf of NOAA**.** For comparison purposes, the National Science Foundation and the Office of Naval Research both provide greater support to the academic community in ocean research than does NOAA. And NSF's and ONR's ship use comes at no cost to the grant. This is a "sustained infrastructure" issue

n. There is a not invented here syndrome which is perceived to exist within NOAA so appreciation and attribution for University advances of science and technology of value to NOAA are typically ignored. Alternatively, the University community is perceived by NOAA to be unappreciative of the support it does receive and does not always acknowledge the support that is provided by NOAA. So, the partnership is perceived as being weak on both sides and could improve with better communications and cross-credit sharing

o. Poorly conceived and structured earmarks which do not comport with the core NOAA mission and end up wasting valuable NOAA resources on parochial, process driven local science for which (and rightfully so) competitive grants, peer reviewed support is generally denied by agencies

2. Do you agree with the U.S. Commission on Ocean Policy recommendations with respect to NOAA? If not, why not?

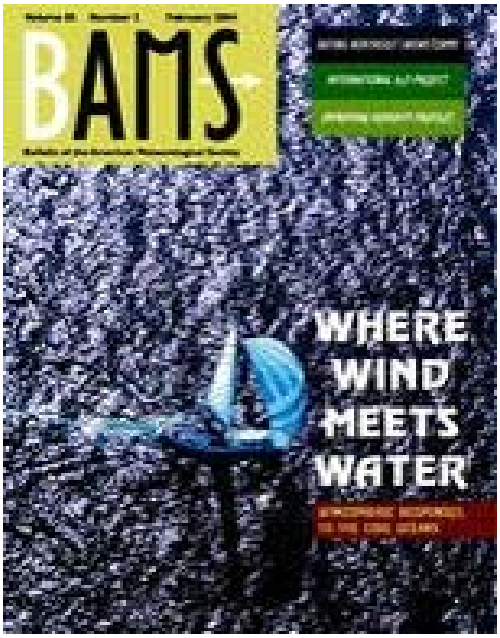
Generally "yes" on most of the 198 specific to NOAA, with several exceptions. Overall, I believe that the recommendations are very bold. My exceptions are based on my perceptions of some of the recommendations not going far enough.

Overall, I agree with and believe that the 198 NOAA centric recommendations are on target and bold with several variances.

a. Rec. 8.9: The Chronicle of Higher Education has already made a compelling case that colleges and universities consider the fulfillment of general education science requirements by introducing very relevant “meteorology and oceanography” courses for Liberal Arts and other majors

b. Rec. 12.4: Federal agency assessments of the outcomes of past federal projects within coastal watersheds and ecosystems will not produce an independent and thus credible evaluation. The University could play an important role as an independent referee here.

c. Rec. 26.2: A truly integrated ocean observing system must include the collection of atmospheric state variables at all ocean state variable observing sites as alluded to I an article in a recent Bulletin of the American Meteorological Society written by a NOAA scientist



d. 26.7 The limited connection that presently exists between ecosystem system modeling and hydrologic systems in a truly interactively coupled suite of models including atmosphere, ocean, coastal ocean, estuary, river, physical, biological, chemical system and even human socio-economic impacts modeling must be highlighted and properly addressed. Herein, the immediate future holds for numerical models that routinely forecast all environmental state variables over multiple space and time scales; down to minutes and a few tens of yards in some cases.

3. Are there limitations to NOAA's ability to carry out the new responsibilities the U.S. Commission on Ocean Policy recommends? If so, please explain those limitations.

In the context of the recommendations the principal limitation is money.

At a minimum, there should be a doubling of the Federal ocean research budget from today's $630M to $1.3B over the next 5 years not only to bring it back to its 7% parity level with the 1980s but more importantly because of what it would do for the Nation. Congressional action would clearly be required in order to double ocean research spending. Additionally, the move to 5-year science plans and 3-year grant cycles would both be made significantly more feasable with Congressional cooperation. Doubling the national investment in oceanic research would have an immediate positive impact within NOAA and the academic community and thus improve forecasting and stewardship capabilities. An increase in research capacity in the form of scientific infrastructure and graduate student researchers could be achieved in very short order and build greatly enhanced capacity for NOAA.

The most likely form of question by the public would be a question of why it is so important to be doubling oceanographic research at this moment and in the present fiscal environment. The answers should be framed in the context of the extreme societal demands that are being placed on coastal and ocean resources:

- More than half of the Nation's population lives in the coastal zone, including the continental U.S. coastlines, Alaska, Hawaii and the Great Lakes; in fact in some coastal regions population growth over the past century has been exponential
- While only 15 % of the Nation's coastal areas are presently developed, that figure is projected to rise to 25 % within the next two decades; in fact in some coastal areas the value of housing (adjusted to the Nation's Consumer Piece Index) has grown exponentially over the past half-century
- Between 70-75% of all weather related losses over the past two decades have occurred in the coastal zones
- Projected sea level rise may greatly exacerbate future weather related impacts in the coastal ocean regions
- Projected shifts in climate will greatly impact the economies of coastal communities
- Coastal communities have expressed great need for integrated oceans, coasts, and estuary centric products, services and delivery mechanisms for weather and climate related impacts. Prognostic capabilities must include development of high-resolution models and observations and data management and delivery systems that inform federal, state, and local agencies.

However:

- There is only sparse information presently available in and over the ocean, coastal and estuary environs. Examples include sparse marine buoy, coastal water level, CMAN, ocean, coastal and estuary mooring system based data

- NWS verifications (the NWS national forecast verification Program) of forecast accuracy indicates that weather forecasts over land are far more accurate than are forecasts along the coasts and out over the ocean
- There are many boating deaths and drowning of swimmers that are directly attributable to the lack of accurate coastal zone forecasts of sea state and currents. It is noteworthy that "rip currents" are responsible for the second largest number of fatalities ascribed to "weather"
- In 2003 the NWS determined that the addition of several new buoys lead to a dramatic improvement of significant wave height forecast capability lending credence to the assumption that more data in coastal areas will improve forecasts
- Coastal ocean and estuary academic community developed coupled models of storm induced surge and flooding have proven to be very accurate and demonstrate that an advanced systems modeling approach, both deterministic and probabilistic, will significantly improve forecast accuracy

Our living and non-living marine resources are in a great state of peril, yet there are few sustained exploratory missions to adequately measure, monitor, and model the great oceans. By comparison to the existing investment in research to understand our planet's vast oceans, an order of magnitude more dollars are available for fundamental research leading to determination of whether there is water on other planetary bodies. Our ocean-going fleet of ships, aircraft, and in-situ buoy systems are numbered in the hundreds and are always overcommitted. Funds to support ocean-going research experiments are extremely limited and are frequently the component of research funds that are reduced when any funding rescissions have to be absorbed.

Whereas the previous 50 years were the half-century of rapid progress in numerical weather prediction and atmospheric sciences, the next 50 years could be the era of even more rapid development in the understanding of the ocean and its major influence on everyday life including weather over land. Using the advances developed in the world weather community, the capability for highly professional operational ocean services that would support coastal communities, ocean-related industries, and ocean weather prediction is now clearly possible. In this sense, an expansion of the professional oceanography economic sector could be anticipated along the lines of the meteorological service industry**.**

Federal funding for technology should be on a par with the requested increase for ocean research to ensure the Nation has the requisite tools, including the Integrated Coastal and Ocean Observing and Prediction Systems, to conduct a rigorous program of ocean science.

The Integrated Ocean Observing System and other key elements of the technological infrastructure that support ocean research should be fully funded. Moreover a robust atmospheric component should be added throughout the entire IOOS and should become an integral part of the IOOS. The Coastal Ocean Observing System should also be highlighted and embellished as a core component of the IOOS. It often gets

overlooked.

NOAA's satellites, ships, aircraft, buoy networks and laboratory facilities also provide a vital base for coastal and oceanic research activities. Funding to maintain this existing national asset and should also be considered and should be available for the conduct of NOAA projects.

As a corollary to the above, there should be a Federal research policy which urges Congress to demand the Administration develop cross agency coordinated 5-year science plans to improve stability in the research base. Congress should with the Administration in developing this planning process as the current annual appropriations process does not lend itself to 5 year forward funded programs.

NOAA should partner with other federal ocean agencies to adopt a unified grants process within each agency, which also employs 3-year grants. Additionally, NOAA should work ambitiously to streamline its grants process

The transition of research into operations is a critical issue for NOAA that is actively being addressed by the NOAA Research Council, the NOAA Science Advisory Board, and the Blue Ribbon Research Review Panel. Hopefully this issue will be properly resolved.

4. **Would it be helpful for NOAA to have an organic act? Why? What would be most important to include in such legislation?**

   NOAA needs to have an Organic Act so it can have clear and specific responsibilities assigned to it with an unambiguous partitioning of responsibilities. Otherwise NOAA's responsibilities are defined by a collection of non-connected laws and policies. These laws were often developed in response to specific issues rather than being in response to the generic, fundamental mission and role of NOAA in the context of its relationship to other federal agencies.

If there is limited new money available from the Federal government, what are the top three recommendations regarding NOAA you believe should be implemented without delay? I will do this by linking some of the overlapping recommendations.

- **Support of the linked Recommendations 23.5, 23.6, 26.2, 26.9, 15.1, 15.2, 15.3, to fully implement an end to end architecture for the complete optimal suite of measurement sites of ocean, atmospheric and hydrologic physical, chemical, biological state variables, for data recovery, for data assessment, for data dissemination, for data archiving and for data access; all in real time and on the fly**

- **Support for the development of a truly cross-cutting oceanic, coastal, atmospheric, hydrologic physical, biological, chemical, human socio-economic impacts integrated, complete Earth System Modeling and Operational Forecast capability (Recommendations 27.2, 27.5, 28.2)**

- **The development of an ambitious Socio-Economic capability, broadly defined, that supports and will help NOAA better meet its mission to serve the citizenry of the Nation, build capacity for the Nation and build a greatly expanded stakeholder network of NOAA supporters (Recommendation 25.3)**

I thank you for this opportunity to meet with you, applaud you for your hosting of this important hearing, applaud the extraordinary efforts of the USCOP, and would be happy to provide any additional information and personal opinions to you and your staff.